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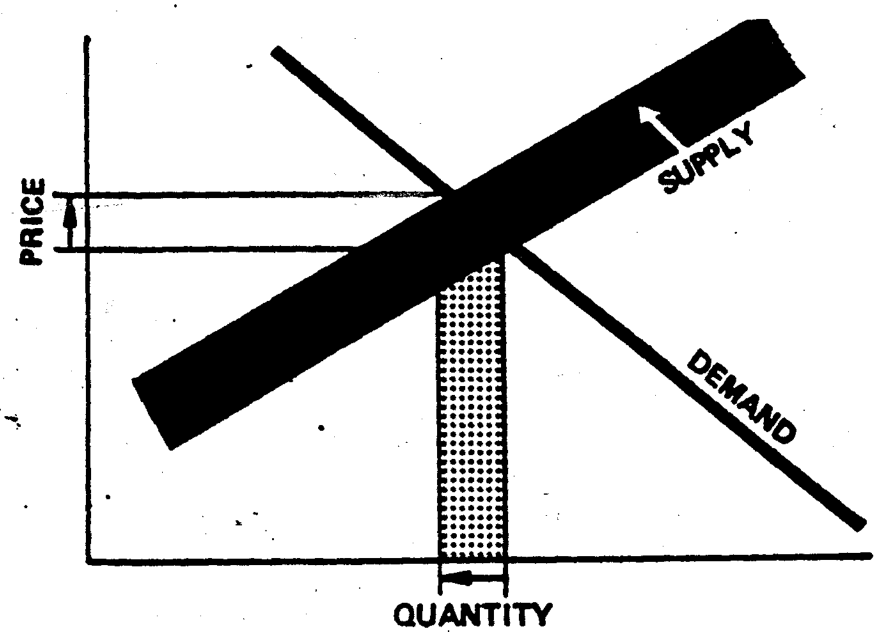
Economic Analysis of Shifting Ocean Disposal of Sewage Sludge from the 12-Mile Site to the 106-Mile Site



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ECONOMIC ANALYSIS OF SHIFTING OCEAN DISPOSAL OF SEWAGE SLUDGE FROM THE 12-MILE SITE TO THE 106-MILE SITE

To
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Office of Analysis and Evaluation
Washington, D.C. 20460

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PREFACE

This document is a contractor's study prepared for the Office of Analysis and Evaluation of the Environmental Protection Agency (EPA). The purpose of this study is to analyze the costs and economic effects of shifting ocean disposal by New York/New Jersey sewerage authorities from the site which is currently used (12-mile site) to a 106-mile site. Therefore, an analysis of the sewerage authorities involved, ocean disposal costs at both sites, and the estimated economic impacts of relocating the disposal site are included in the ensuing chapters.

The study was prepared with the supervision and review of the Office of Analysis and Evaluation of EPA. This report was submitted in fulfillment of Contract No. 68-01-6745 by Development Planning and Research Associates, Inc. and completed in April 1984.

CONTENTS

I. EXECUTIVE SUMMARY

A. Introduction and Methodology

The background and purpose of this report are presented in the introduction summary below. A brief summary of the methodology used to prepare this report is also included in this section.

1. Introduction

Sewerage authorities in the New York/New Jersey area currently dispose of sewage sludge at the 12-mile ocean disposal site. There are two alternative ocean disposal sites approximately 60 miles and 106 miles from the New York Harbor. The 60-mile site has been used for dumping digester clean-out sludges and industrial wastes. All ocean dumping of sewage sludge was to have stopped in 1981, but has continued under court order. In 1982, New York/New Jersey sewerage authorities disposed of 7.6 million wet tons of sewage sludge, at the 12-mile site. The total cost of transporting sewage sludge to the 12-mile site was $13 million as reported by New York/New Jersey Publicly Operated Treatment Works (POTW's).

Section 102(c) of the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA) gives EPA the authority to designate areas of ocean disposal of sewage sludge and industrial wastes. The purpose of this study is to present the costs and economic effects of shifting disposal options from the 12-mile site to the 106-mile site. Therefore, an analysis of the sewerage authorities involved, ocean disposal costs at the 12-mile site and 106-mile site, and the estimated impacts of users are included in this report.

2. Economic Impact Methodology

Methodologies which were used to produce earlier studies by EPA and other organizations such as the Municipal Finance Officers Association were employed in the preparation of this report. Some minor alterations were necessary due to data availability.

The economic impact methodology consisted of five basic parts, which are summarized below.

1. Develop community baselines - Secondary data sources were used to collect the following information for each community: the volume of waste generated during 1982, the number of users served by each facility by user type, sewage fees by user group and general demographics.

2. Estimate incremental ocean disposal costs - Transportation costs of disposal at the 106-mile site were estimated. Cost of disposal at the 12-mile site was then subtracted from the 106-mile site transportation costs to estimate incremental costs.

3. Determine residential user effects - The percent increase in user cost was estimated by dividing incremental 106-mile site costs by baseline sewage fees to approximate charge increases. Where additional specific data were available on residential users the following measures of economic impacts were used as guidelines:

Indicator	Threshold level
1. Annual cost (debt service + O&M) per household	$200
2. User cost indicator $\frac{\text{User Cost}}{\text{Median income}}$	1%

These guidelines are from the "Financial Capability Guidebook." If costs or computations exceed the guideline threshold level, economic impacts are forecast.

4. Determine industrial user effects - Industrial user effects were established as a percent increase in user fees. In order to compute this percentage of increase, the current level of sewage charges was established and incremental costs were divided by existing charges.

A percent price increase for industrial users was then estimated by dividing incremental 106-mile site costs by the manufacturing value of shipments for the community from the Census of Manufacturers. A threshold of a 1.0 percent price increase was used for determining impacts.

5. Assess capital availability for affected communities - An analysis of each community's financial conditions was performed using bond ratings from Standard and Poor's guide to bond rating. If recent bond ratings for the communities were below an A rating, capital availability problems are indicated.

B. Sewerage Authority Profiles

The sewerage authorities that would be affected by a denial of the petitions to designate the 12-mile site in conjunction with the designation of the 106-mile site are listed below.

New York	New York City Nassau County Westchester County
New Jersey	Bergen County Passaic Valley Middlesex County Linden/Roselle Rahway Valley Joint Meeting

Each of these sewerage authorities currently dispose of their sludge wastes at the 12-mile site. Linden/Roselle and Rahway Valley have been combined for the analysis because they treat sludge wastes together.

1. Sludge Management Systems

The POTW's operated by the sewerage authorities all have secondary treatment in place. New York City operates eleven POTW's all of which use ocean disposal for sludge wastes. Nassau County operates eight POTW's and Westchester County operates four POTW's. The New Jersey sewerage authorities each operate one POTW.

Over 7 million wet tons of sewage sludge are disposed annually by all of the sewerage authorities. New York City accounts for about half of this total at 3.2 million wet tons. Passaic Valley is the next largest generator of sludge with 1.7 million wet tons per year. Generally the percentage of solids in the sludge ranges from 2 to 4 percent, though one New York City POTW has achieved a 9 percent solids content.

Sludge dewatering is one action that sewerage authorities can take to reduce sludge volumes and thus transportation costs. Several of the New York and New Jersey sewerage authorities have dewatering in place that is not used for ocean disposal because of the capacity of pumping equipment and that dewatered sludge floats causing environmental problems. Most of the dewatering equipment was installed for use with land-based disposal alternatives such as; incineration which is currently not feasible due to air pollution control requirements.

2. Number of Users

Each sewerage authority treats the wastes of several municipalities. The number of municipalities ranges from five in Nassau County to forty-three in Bergen County. The municipalities provide local sewer hook-ups for residential, commercial and industrial users. The number of residents served by the eight sewerage authorities is about 10 million, nearly half of which are located in New York City. Passaic Valley with 5,000 has the most industrial users.

3. Community Demographics

Demographic data for the communities affected are summarized below in tabular form. The source of this information was the U.S. Census Bureau Publications and the individual sewerage authorities.

Sewerage authority	Residential users (thousands)	Median income (1979) ($)	Percent below poverty level (1979) (%)	Number of commercial and industrial users	Bond ratings
NEW YORK					
New York City	5,302	13,854	17.2	N.A.	AAA
Nassau County	889	26,090	3.6	1,640 est.	AAA
Westchester County	484	22,725	5.6	1,192	AA+
NEW JERSEY					
Bergen County	476	24,053	3.1	N.A.	AAA
Passaic Valley	1,300	17,907	10.5	5,000	AA
Middlesex County	609	22,826	4.7	1,300	A
Linden/Roselle/Rahway	279	21,061	6.0	2,973	AA
Joint Meeting	459	18,207	6.8	1,626	AA
Total	9,798				

C. Ocean Disposal Costs

1. Background

This section reviews the development of ocean disposal costs. Transportation cost components for ocean disposal were collected from sewerage authorities and sludge transporters and then estimated for the volume of sludge to be disposed of at the 106-mile site. The methodology and assumptions used in estimating costs are presented followed by the cost estimates.

2. Methodology and Assumptions

The cost methodology involved simple aggregations for each sewerage authority based on its sludge generation rate and the estimated unit cost of disposing at the 106-mile site. Factors which will influence costs are: the season of the year, changes in POTW service, and level or type of treatment or industrial pretreatment.

Currently three types of ocean disposal vessels are used in the study area. They are:

- vessels owned by the sewerage authorities
- barges operated by A&S Transportation Inc.
- small tankers operated by General Marine Transport

The methodology assumes that any shortfall of vessel capacity will be made up with vessels at the same cost as the existing commercial fleet.

3. Disposal Costs

The estimated costs for the 12-mile and 106-mile sites for each sewerage authority are shown in Table I-1. Total transportation costs are $39.4 million. The incremental cost for the 106-mile site is the difference between the two sites' costs and is $24.4 million for all sewerage authorities. The incremental annual costs range from $344 thousand for Linden/Roselle/Rahway up to $11.3 million for New York City.

D. Economic Impacts

The economic impacts of the designation of the 106-mile site are discussed below. The incremental costs to transport sludge to the 106-mile site were compared to current baseline sewage treatment and disposal costs to determine economic effects. The costs of additional sludge storage were not included in this analysis because storage requirements are unclear and costs were not available.

1. Community Baseline Conditions

Current sludge disposal transportation costs at the 12-mile site as a percent of total treatment costs range from 6 percent in New York City to 23 percent at Westchester County. Thus, sludge transport is a significant portion of total treatment costs. The total sewerage budgets range from $3.6 million for Joint Meeting to $55.1 million for New York City.

2. Effects on Residential Users

The percent cost increase in sewage fees to all users when costs to the 106-mile site are added are shown as follows.

Sewerage authority	Percent Cost Increase (%)
New York	
New York City	21
Nassau County	13
Westchester County	12
New Jersey	
Bergen County	13
Passaic Valley	14
Middlesex County	7
Linden/Roselle/Rahway	4
Joint Meeting	15

The average cost increase is 15 percent. A more specific measure of impacts on residential users can be computed by determining the cost per user. This measure calculated by dividing the costs by the number of users is presented in Table I-2. The incremental cost ranges from $3.51 to $13.21 per year per household. The total annual cost per household for sewage disposal ranges from $26.65 to $86.78.

Table I-1. Incremental annual costs of moving from the 12-mile site to the 106-mile site 1/

Sewerage Authority	12-mile site	106-mile site	Incremental cost
	(thousand dollars)		
NEW YORK			
New York City	3,559	14,880	11,321
Nassau	622	3,266	2,644
Westchester	2,330	3,555	1,225
NEW JERSEY			
Bergen	792	2,277	1,485
Passaic	2,236	7,623	5,387
Middlesex	1,993	3,159	1,166
Linden/Roselle/Rahway	683	1,027	344
Joint Meeting	699	1,554	855
Total	12,914	37,341	24,427

1/ 1982 dollars.

Source: Abt Associates, Inc.

Table I-2. Annual baseline and incremental cost per household

Sewerage authority	Annual baseline cost	Incremental cost	Total annual cost per user
	----------------$ per household----------------		
NEW YORK			
New York City	64.26	13.21	77.47
Nassau County	53.56	7.27	60.83
Westchester County	56.94	6.99	63.93
NEW JERSEY			
Bergen County	76.88	9.90	86.78
Passaic County	55.68	8.00	63.68
Middlesex County	54.72	3.61	58.33
Linden/Roselle/Rahway	54.03	2.44	56.47
Joint Meeting	23.13	3.51	26.65
Weighted Average	59.59	10.16	69.75

Source: DPRA.

Table I-3 summarizes the economic effects in residential users based on the threshold levels presented in the methodology. These costs are below the $200 threshold indicator presented in the methodology. Also, the user cost divided by median income indicator shows values from 0.1 percent to 0.6 percent for all sewerage authorities. The economic impact threshold level for this indicator is 1.0 percent. Based on this analysis a small economic impact is expected for residential users due to designation of the 106-mile site.

3. Effects on Industrial Users

Industrial user impacts were assumed to follow the percent cost increase shown in section 2 above for all users which averaged 15 percent. The percent price increase for moving to the 106-mile site for industrial users was estimated by comparing the city or county's manufacturing value of shipments to the incremental ocean disposal costs for industrial users in that community. These estimates are shown below:

Sewage authority	Incremental industrial cost (millions of dollars)	Manufacturing value of shipments (millions of dollars)	Percent price increase %
New York City	3.1	42,400	.01
Nassau County	.3	4,800	.01
Bergen County	..04	6,500	.001
Passaic County	1.9	3,200	.06

The percent price increases shown above are low. Sewage fees would have to account for at least 10 percent of a firm's total sales before impacts would be expected in this group.

4. Capital Availability

The sewerage authorities have all made recent bond placements without incurring high increased costs. Since capital requirements are expected to be low for switching to the 106-mile site and all sewerage authorities have bond ratings of A or better, capital availability is not expected to be a constraint.

E. Limits of the Analysis

This section presents estimates of the general accuracy of the study, data availability, critical assumptions and sensitivity analysis.

1. General Accuracy

Generally data were complete and accurate for each sewerage authority. Site visits were conducted to obtain data necessary to complete the analysis for all sewerage authorities studied. While the accuracy of the report was enhanced by the cooperation of the sewerage authorities and data availability, qualitative judgements were involved, thus, the possibility of errors exists.

Table I-3. Summary of economic effects on residential users due to redesignation of the 106-mile site

Sewerage authority	Annual cost (debt service & O&M) per household	User cost / Median income
	(threshold $200)	(threshold 1 percent)
NEW YORK		
New York City	77.47	.6
Nassau County	60.83	.2
Westchester County	63.93	.3
NEW JERSEY		
Bergen County	86.78	.4
Passaic Valley	63.68	.4
Middlesex County	58.33	.3
Linden/Roselle/Rahway	56.47	.3
Joint Meeting	26.65	.1
Weighted Average	69.75	.5

Source: DPRA.

2. Data Availability

Estimates were made to determine the 106-mile site transportation costs. Information on sludge storage requirements and costs would improve the accuracy of the report. Also additional data on the technical aspects and costs of dewatering would clarify the analysis.

3. Critical Assumptions

Assumptions were made concerning future sludge volumes, future transportation capacity and changes in transportation costs. Variations in these assumptions would have to be significant to change the low economic impacts presented in the study. The reduction of sludge volumes by dewatering was not assumed in the analysis but could reduce disposal costs depending on its cost-effectiveness for each sewerage authority.

4. Sensitivity Analysis

The effects of changes in estimates of transportation costs, sludge volumes and baseline sewage costs were evaluated. These changes would not effect the overall study results.

II. INTRODUCTION AND METHODOLOGY

A. Introduction

Under Section 102(c) of the Marine Protection, Research and Sanctuaries Act of 1972 (MPRSA), EPA designates areas for ocean disposal of sewage sludge and industrial wastes. The Office of Water established the Ocean Disposal Site Designation Task Force to evaluate ocean dumping sites in the New York/New Jersey area. In 1982, area POTW's disposed of 7.6 million wet tons of sewage sludge at three ocean disposal sites. These sites, named for their approximate distance from New York harbor are the 12-mile site, the 60-mile site and the 106-mile site. Currently all of the sewage sludge is disposed of at the 12-mile site.

A map showing approximate locations of sludge disposers is presented in Figure II-1. The total cost in 1982 by all POTW's to transport sludge to the 12-mile site was $13 million. The ocean dumping of sewage sludge was to stop by the end of 1981 and land-based disposal alternatives were to be used. Since then ocean disposal at the 12-mile site has continued under court order. Construction of incineration facilities was started by several sewerage authorities as a land-based alternative but was stopped due to air pollution considerations. The cost of planned land disposal alternatives to ocean disposal was estimated to cost up to 10 times 1/ more than ocean disposal and possibly have more serious environmental effects. A list of the planned land-based alternatives for each of the sewerage authorities is presented below.

Sewerage authority	Land-based alternative 2/
NEW YORK	
New York City	Dewatering, composting (short-term) Pyrolysis (long-term)
Nassau	Composting/landfill/incineration
Westchester	Composting/landfill/incineration
NEW JERSEY	
Bergen County	Composting
Passaic Valley	Storage (short-term) Incineration (long-term)
Middlesex	Landfill (short-term) Incineration (long-term)
Linden/Roselle/Rahway	Landfill (short-term) Incineration (long-term)
Joint Meeting	Incineration

1/ Economic Impacts of the Ban on Ocean Disposal of Sludge. 1980 (June). Booz-Allen and Hamilton, Inc.

2/ Source: Ibid.

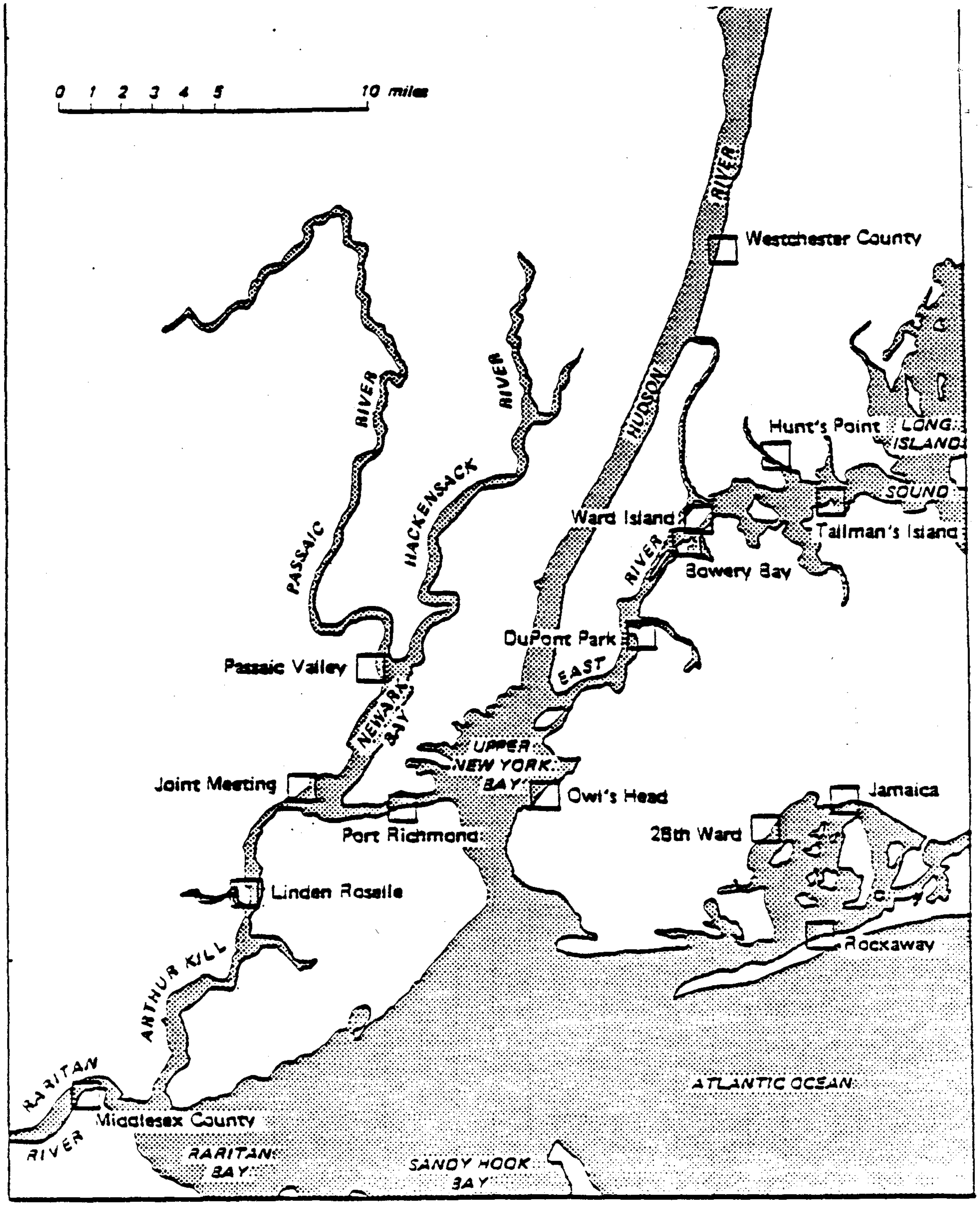

Figure II-1. Locations of Sludge Loading Piers in the New York, New Jersey Port Area.

Source: Table taken from: Temple, Barker and Sloane, Inc., <u>Costs of Ocean Disposal of Municipal Sewage Sludge and Industrial Wastes</u>, Office of Analysis and Evaluation, U.S. Environmental Protection Agency, 1982 (September), p. I-6.

The purpose of this study is to present the costs and economic effects of designation of the 106-mile site as the only municipal sewage sludge disposal site. Public comments from affected communities, citizens and interest groups received at site designation hearings and comment periods estimated that the cost to transport sludge to the 106-mile site would be three to four times the cost at the 12-mile site and that significant economic impacts were expected.

The 106-mile site is located off the Continental Shelf and is 450 square miles in area, ranging in depth from 4,725 to 9,023 feet. Since 1961 both chemical wastes and digester cleanout have been disposed at this site. The site's depths are expected to permit rapid dilution and dispersion of wastes, and will minimize the adverse environmental effects. This study did not evaluate the environmental effects of changing ocean disposal of municipal sewage sludge to the 106-mile site. Also the costs and effects of disposing of industrial wastes at the 106-mile site are not presented.

Presented in subsequent chapters are an analysis of the sewerage authorities involved, ocean disposal costs at the 12-mile site and 106-mile site, the estimated economic impacts of users, and limits of the analysis. The remainder of this chapter presents the methodology used to measure economic impacts presented in the following chapters.

B. Economic Impact Methodology

A variety of analytical techniques could be used to determine the economic effects of designation of the 106-mile ocean disposal site. Conceptually, all methods would produce nearly identical results. However, data availability was necessarily a requisite consideration in selecting the methodologies employed.

Considerable work has already been completed by EPA and other organizations such as the Municipal Finance Officers Association on developing guidelines for assessing the capability of a given community to finance a particular treatment system or to assess the impact on the population of that community in terms of an increase in sewage fees. The methodology described below follows this previous work with some minor alterations due to the available data.

The economic impact methodology consisted of five basic parts:

1. Develop community baselines,
2. Estimate incremental ocean disposal costs,
3. Determine residential user effects,
4. Determine industrial user effects, and
5. Assess capital availability for affected communities

1. Community Baseline

A community baseline is defined for each sewerage authority. Economic impacts are then measured from the baseline. Information included in the baseline are:

1. Volume of waste generated for 1982,
2. Number of users served by each facility by type of user,
3. Community demographics,
   a. per capita income,
   b. household income
   c. unemployment,
   d. retail sales,
   e. manufacturing value of shipments,
   f. S&P's bond ratings, and
4. Sewage fees by user group.

Types of data collected for each baseline estimate are further presented in sections below.

2. Incremental Ocean Disposal Costs

The incremental transportation costs of ocean disposal at the 106-mile site were estimated from data collected from transporters, sewerage authorities and secondary data sources. Incremental costs were estimated by subtracting the total cost at the 12-mile site from the total 106-mile site cost. Incremental residential and industrial user costs were allocated based on proportional total baseline costs (shown in Table V-1). Additional information on the methodology and assumptions used for estimating costs are presented in Chapter IV.

3. Residential User Effects

The percent increase in user cost was estimated by dividing incremental 106-mile site costs by baseline sewage fees to approximate charge increases. Where additional specific data were available on residential users the following measures of economic impacts were used as guidelines:

Indicator	Threshold level
1. Annual cost (debt service + O&M) per household	$200
2. User cost indicator $\frac{\text{User Cost}}{\text{Median income}}$	1% or 0.75% 1/

1/ One percent is considered a conservative surrogate for the 1%, 1.5% and 1.75% indicators previously used by the agency. The 0.75 indicator is used for new projects when users are already paying a service charge on existing projects. Government Finance Research Center and Peat, Marwick, Mitchell and Co., "Financial Capability Guidebook," (DRAFT), EPA, May 14, 1982.

If costs or computations exceed the guideline threshold level, economic impacts are forecast.

4. Industrial User Effects

Industrial user effects are presented as a percent increase in user fees by dividing the incremental increase in costs by the baseline sewage charge. This was completed for the overall community as a proxy for industrial user effects and where possible, specific industrial group percent increases were computed.

The following tasks were required for this estimate.

1. Determine current level of sewage charges.

2. Divide the incremental costs by the existing charges to determine the percentage cost increases.

A percent price increase for industrial users was then estimated by dividing incremental 106-mile site costs by the manufacturing value of shipments for the community from the Census of Manufactures. A threshold of a 1.0 percent price increase was used for determining impacts.

5. Capital Availability

Assessing a community's ability to raise the necessary funds for a capital intensive project first requires an analysis of the community's financial conditions. The accomplishment of this analysis will require that four separate questions are answered:

1. What is the Community's debt history?

2. What is the Community's financial condition?

3. What is the debt capacity of the community?

4. Does the existing debt capacity allow sufficient room to cover the alternatives under consideration?

Bond ratings from Standard and Poor's were used as an approximation of these four financial conditions. Bond ratings are based on analysis of the requirements for specific projects. The determination of ratings is discussed on page III-18. For a conservative approach it was assumed that recent bond ratings below A would indicate problems with capital availability.

III. SEWERAGE AUTHORITY PROFILES

This chapter presents information on the sewerage authorities affected by the change to the 106-mile site. Eight sewerage authorities and one municipality (New York City) are listed below.

State	Sewerage authority
New York	New York City Nassau County Westchester County
New Jersey	Bergen County Utility Authority Passaic Valley Sewerage Commissioners Middlesex County Utility Authority Linden/Roselle Sewerage Authority Rahway Valley Sewerage Authority Joint Meeting

Because Linden/Roselle and Rahway sewerage authorities combine their wastes for transport to the disposal site they are treated as one unit in this report. Several of the sewerage authorities operate more than one POTW, with New York City operating eleven POTW's.

The information that were used to develop community baseline conditions are presented by subject area. First, the sludge management systems are described in terms of the treatment systems, the waste profiles, the dewatering practices, storage systems and monitoring, and surveillance practices. Second, the sewerage authorities are described in terms of the number of users. Finally, the demographics of the sewerage authority communities are detailed. This demographic information includes population characteristics, annual income, employment, retail sales, value of shipments and municipal bond ratings.

A. Sludge Management Systems

1. Types of Treatment

Table III-1 lists the POTW's operated and the waste treatment utilized by the various sewerage authorities. The types of primary treatment, secondary treatment, other types of treatment and dewatering facilities are also included on the table. To date, each sewerage authority has some type of secondary treatment in place, usually activated sludge. Of the twelve sewerage authorities with dewatering facilities, nine employ vacuum filters, two use centrifuges, and one uses a filter press.

In the state of New York, the New York City sewerage authority operates eleven POTW's. Each of these POTW's use activated sludge as a form of secondary treatment. The Nassau County sewerage authority consists of

Table III-1. Forms of POTW treatment

Sewerage authority	Type of primary treatment	Type of secondary treatment	Other types of treatment	Type of dewatering facilities
NEW YORK				
• New York City				
Wards Island	Bar screen Grit removal Primary sedimentation	Conventional Activated Sludge	Chlorination Effluent outfall Anaerobic digestion Gravity thickening	Vacuum filter 1/
Hunts Point	Bar screen Grit removal Comminutors Primary sedimentation	Conventional Activated Sludge	Effluent outfall Anaerobic digestion Air drying Gravity thickening	Vacuum filter 1/
26th Ward	Bar screen Grit removal Primary sedimentation	Conventional Activated Sludge	Chlorination Effluent outfall Anaerobic digestion Gravity thickening	NA
Coney Island	Bar screen Grit removal Primary sedimentation	Conventional 2/ Activated Sludge High Rate Activated Sludge	Effluent outfall Anaerobic digestion Gravity thickening	NA
Owls Head	Bar screen Grit removal Preaeration Primary sedimentation	Conventional 2/ Activated Sludge	Effluent outfall Anaerobic digestion	NA
Newton Creek	Bar screen Grit removal Comminutors Preaeration Primary sedimentation	Conventional Activated Sludge	Chlorination Effluent outfall Anaerobic digestion Air flotation	NA
Tallmans Island	Bar screen Preaeration Primary sedimentation	Conventional Activated Sludge	Effluent outfall Other treatment Anaerobic digestion Heat treatment	Centrifuge 1/
Bowery Bay	Bar screen Primary sedimentation	Conventional Activated Sludge	Effluent outfall Anaerobic digestion Other treatment Gravity thickening	Vacuum filter 1/
Rockaway	Bar screen Grit removal Preaeration Primary sedimentation	Conventional 2/ Activated Sludge	Effluent outfall Other treatment Anaerobic digestion Gravity thickening	NA
Oakwood Beach	Bar screen Preaeration Primary sedimentation	Conventional Activated Sludge	Effluent outfall Anaerobic digestion Gravity thickening	NA
Port Richmond	Bar screen Preaeration Primary sedimentation	Conventional Activated Sludge	Effluent outfall Other treatment Anaerobic digestion Gravity thickening	NA
• Nassau County				
Bay Park	Bar screen Grit removal Comminutors Primary sedimentation	Conventional Activated Sludge	Effluent outfall Recalcination Anaerobic digestion Air flotation	Vacuum filter 3/

Table III-1 Forms of POTW treatment (continued)

Sewerage authority	Type of primary treatment	Type of secondary treatment	Other types of treatment	Type of dewatering facilities
Cedar Creek	Bar screen Grit removal Preaeration Primary sedimentation	Conventional Activated Sludge	Effluent outfall Recalcination Anaerobic digestion Air flotation	Vacuum filter
Inwood Sewage	Bar screen Grit removal Primary sedimentation	Rock media Trickling Filter	Chlorination Effluent outfall Anaerobic digestion	Vacuum filter
Belgrave	NA	NA	NA	NA
Roslyn	Bar screen Primary sedimentation	Rock media Trickling Filter	Chlorination Effluent outfall Gravity thickening Anaerobic digestion	NA
West Long	Bar screen Primary sedimentation	Rock media Trickling Filter	Chlorination Effluent outfall Anaerobic digestion	NA
Long Beach	Bar screen Primary sedimentation	Rock media Trickling Filter	Chlorination Effluent outfall Anaerobic digestion Heat treatment	Vacuum filter
City of Glen Cove	Bar screen Grit removal Primary sedimentation	High rate Activated Sludge	Biological nitrification, 4/ Chlorination, Effluent outfall Sludge holding tanks Flotation thickening Coincineration with solid waste Anaerobic digestion Gravity thickening	Filter press 5/
• Westchester County				
Buchanan	Bar screen Grit removal Preaeration Comminutors	Extended Aeration Activated Sludge	Chlorination Effluent outfall Sludge lagoons Air drying	NA
Yonkers	Preaeration Bar screen Grit removal Primary sedimentation	Conventional Activated Sludge	Chlorination Effluent outfall Grit removal Gravity thickening Flotation thickening Anaerobic digestion	Centrifuge
Port Chester	Bar screen Grit removal Preaeration Primary sedimentation	Conventional 6/ Activated Sludge	Chlorination Sludge trucked to manhole for discharge to Yonkers STP, Anaerobic digestion 7/ Heat treatment Gravity thickening Multi-hearth Incineration	Vacuum filter
Blind Brook	Bar screen Grit removal Primary sedimentation	Conventional 8/ Activated Sludge	Chlorination Sludge trucked to manhole for discharge to Yonkers STP, Heat treatment Wet air oxidation 9/	Vacuum filter

Table III-1 Forms of POTW treatment (continued)

Sewerage authority	Type of primary treatment	Type of secondary treatment	Other types of treatment	Type of dewatering facilities
NEW JERSEY				
• Bergen County	Bar screen Grit removal Primary sedimentation	Contact Stabilization Activated Sludge	Effluent outfall Anaerobic digestion Gravity thickening Sand filter	NA
• Passaic Valley	Bar screen Grit removal Primary sedimentation 10/	Pure oxygen Activated Sludge	Chlorination Effluent outfall Gravity thickening Heat treatment (Zimpro) 11/	NA
• Middlesex	Bar screen Grit removal Primary sedimentation	Blue oxygen Activated Sludge	Clorination Effluent outfall Aerobic digestion Gravity thickening	NA
• Linden-Roselle	Bar screen Grit removal Primary sedimentation	Conventional Activated Sludge Roughing Filter Trickling	Effluent outfall Microstrainers Recalcitration Gravity thickening Anaerobic digestion Flotation thickening Chlorination	Filter press
• Rahway Valley	Bar screen Grit removal Preaeration Primary sedimentation	Conventional Activated Sludge	Chlorination Effluent outfall Gravity thickening Anaerobic digestion Digested sludge pumped to storage tanks at Linden/Roselle STP	Filter press
• Joint Meeting (Union & Essex)	Bar screen Grit removal Primary sedimentation	Conventional Activated Sludge	Chlorination Recalcitration Microstrainers Effluent outfall Gravity thickening Anaerobic digestion Multiple hearth incineration	NA

1/ Needs survey data indicates that dewatering facilities are being utilized by NYC treatment plants. This data, however, conflicts with the statement of a New York Department of Environmental Protection official's comment that no NYC plants are currently dewatering facilities.
2/ Three NYC treatment plants (Coney Island, Owls Head, Rockaway) utilize preliminary and secondary treatment, but not primary sedimentation. This treatment technology results in reduced BOD and SS removals, and reduced sludge generation rates.
3/ Needs survey indicates that this equipment is currently being installed.
4/ Nitrification mode will not be operated until sludge/refuse incineration is completed.
5/ Needs survey shows construction of the following facilities: gravity thickening, anaerobic digestion, dewatering - filter press, coincineration with solid waste. Coincineration facility currently under construction will burn 25 tons per day sewage sludge (20 % solids).
6/ Needs survey and Westchester County pretreatment submission indicate that Port Chester STP will be upgraded with conventional activated sludge facilities.
7/ Sludge thickening facilities construction is currently underway and scheduled for completion in late 1984. Needs survey indicates use of anaerobic digestion, heat treatment, vacuum filter dewatering and gravity thickening at the Port Chester Sludge Thickening facility. The facility will also handle Blind Brook STP sludge.
8/ Construction of secondary treatment is scheduled for completion in late 1983. Start-up is scheduled for 1984. Secondary treatment at Blind Brook will not commence until Port Chester STP Sludge facility is operational.
9/ Needs survey indicates that Blind Brook will use heat treatment, wet air oxidation, and vacuum filter dewatering. This data entry probably refers to Port Chester facility. Westchester County plans to incinerate Port Chester and Blind Brook sludge in lieu of discharging to the Yonkers STP
10/ New primary clarifiers are under construction and scheduled for start-up between mid-1984 and October 1985.
11/ Sludge dewatering facilities have been built but are not currently in use.
NA = Not Available.
Source: EPA.

eight POTW's. Five of these POTW's have dewatering facilities which are in place or are being constructed. Of the five dewatering facilities, four are vacuum filters, and one is a filter press. Four POTW's comprise the Westchester County sewerage authority. All four POTW's use activated sludge for secondary treatment.

In New Jersey, there are six sewerage authorities, each with one POTW. Each of these POTW's uses activated sludge as a type of secondary treatment.

2. Waste Profiles

Table III-2 shows the amount of sludge dumped quarterly and annually in 1982 by each sewerage authority. Annual sewage sludge generation ranged from 268,958 wet tons by Linden/Roselle/Rahway to 3,206,054 wet tons by New York City.

In most cases, quarterly sludge generation was fairly stable, and a comparison between sewerage authorities did not produce any conclusions regarding seasonal highs or lows. Passaic Valley showed the greatest variation in quarterly sludge generation, ranging from 203,466 wet tons of sludge in the first quarter to 648,332 wet tons of sludge in the fourth quarter. This variation is attributed to the addition of secondary treatment by the Passaic Valley sewerage authority.

Table III-3 shows the percentage of solids for each sewerage authority's sludge. Middlesex showed the highest percentage of solids at 4.2-4.3 percent. Port Richmond (not shown), a POTW under the New York City sewerage authority has the highest percentage of solids at 9.1 percent. Generally, the percentage of solids in the sewage sludge ranged from 2.0 to 4.0 percent.

3. Dewatering

Sludge dewatering is one action that sewerage authorities can take to reduce sludge volumes prior to ocean disposal. The cost of dewatering and the amount of dewatering depends on the technology that is used and the circumstances of the POTW. The appropriate dewatering techniques vary according to the desired solids content and may be constrained by the existing wastewater treatment technologies used by the POTW. Land availability often limits the expansion of a POTW's dewatering efforts to certain technologies.

The optimum solids content depends on design of the vessels serving the sewerage authority, the ability of pumps to handle higher solids sludge and possible environmental effects of dewatered sludge. The amount of dewatering also depends on the volume reduction that can be attained. Most of the possible decreases in volume occur between three percent and ten percent solids, depending on the characteristics of the sludge. A solids content greater than ten percent causes problems in pumping and ocean dispersal of sludges. Finally, the target solids content will reflect the cost of dewatering and the cost of sludge transportation.

Table III-2. Amount of sludge generated quarterly and annually, 1982

Sewerage authority		First quarter	Second quarter	Third quarter	Fourth quarter	Year-end total
NEW YORK						
New York City	wet tons	640,975	715,415	950,880	898,784	3,206,054
	dry tons	18,968	23,133	26,504	24,148	92,753
Nassau County	wet tons	129,000	100,000	96,800	115,500	441,300
	dry tons	3,880	3,000	2,900	3,464	13,244
Westchester County	wet tons	46,332	106,704	146,016	133,584	432,636
	dry tons	1,529	2,913	3,212	2,712	10,366
NEW JERSEY						
Bergen County	wet tons	67,345	75,567	56,955	88,705	288,573
	dry tons	2,647	2,494	1,879	2,892	9,912
Passaic Valley	wet tons	203,466	285,532	556,764	648,332	1,694,094
	dry tons	13,429	19,559	32,626	39,613	105,227
Middlesex County	wet tons	199,956	194,512	203,594	221,893	819,955
	dry tons	8,358	7,107	7,642	9,017	32,124
Linden/Roselle/Rahway	wet tons	70,925	71,142	63,509	63,382	268,958
	dry tons	1,975	2,201	1,878	1,776	7,830
Joint Meeting	wet tons	117,153	108,762	92,380	102,425	420,720
	dry tons	2,908	2,790	2,317	2,506	10,521
Total	wet tons	1,475,152	1,657,634	2,166,898	2,272,605	7,572,290
	dry tons	53,694	63,197	78,958	86,128	281,977

Source: Letters from sewerage authorities.

Table III-3. Solids content of sewage sludge

Sewerage authority	Wet tons	Solids
	(thousands)	(%)
NEW YORK		
New York City	3,206	2.5-3.0
Nassau County	441	2.5-3.0
Westchester County	433	3.0-4.5
NEW JERSEY		
Bergen County	289	3.5-4.0
Passaic Valley	1,694	3.0-4.0
Middlesex County	820	4.2-4.3
Linden/Roselle/Rahway	269	2.0-4.0
Joint Meeting	421	2.5
Total	7,573	2.0-4.0

Source: DPRA site visits to the eight sewerage authorities January 1984.

Several of the New York and New Jersey sewerage authorities have dewatering equipment in place that is not used for a variety of reasons. Some cannot efficiently utilize the dewatering equipment because of such technical constraints as pumping equipment. Some cannot obtain the necessary permits needed to incinerate the dewatered sludge. Some dewatered sludge is too dry to dispose of in the ocean because it floats.

The dewatering equipment of several sewerage authorities is described below:

- Rahway Valley Sewerage Authority has $7 million worth of dewatering equipment that cannot be used because it cannot obtain a permit to incinerate the dewatered sludge. The current solids content is four percent and dewatering ahead of ocean disposal is not feasible because solids cannot exceed five percent with present pumping equipment.

- Linden/Roselle has a belt filter press, with capital cost of $6 million to $7 million, that is not used.

- Joint Meeting has dewatering equipment in place but not in use.

- Passaic Valley Sewerage Commission has a $16 million filter-press dewatering facility not in use.

- Westchester County has designed but not built a dewatering plant.

- Nassau County built a $14 million belt filter-press dewatering plant to use in a composting system but does not have plans to use it.

- Middlesex County invested in a $40 million facility to incinerate dewatered sludge and county refuse in an attempt to reduce power costs. However, the refuse disposal was subsequently awarded to private contractors and the facility is unused.

4. Storage Facilities

Moving sludge disposal to the 106-mile site has implications for the sewerage authorities' storage facilities. Unless they dewater sludge, all sewerage authorities using the 106-mile site will have storage needs exceeding their existing storage for the 12-mile site. There are three reasons for the increased storage needs:

- longer voyages cause longer times between pickups,

- the higher efficiency of large vessels for disposal at the 106-mile site, and

- the higher probability of inclement weather blocking the voyage to the 106-mile site.

Actual storage needs depend on the sewerage authority's daily sludge generation, vessel capacity and the necessary allowances for inclement weather. The optimum storage capacity should be enough to fill the largest vessel used by the sewerage authority. However, the possibility of vessel delays requires larger storage capacity. The only sewerage authority to report storage cost data was New York City, which estimates annual incremental costs of sludge storage to be $2.25 million. This cost estimate was not included in New York City's total baseline cost (shown in Table V-1).

5. Monitoring and Surveillance Practices

Monitoring of sludge wastes and surveillance of dumping are required for both the 12-mile stie and the 106-mile site. Current and proposed practices are discussed below.

Monitoring is necessary to assess the possible adverse impacts of ocean dumping on fisheries, public health and marine systems. The basic elements of a monitoring program would be to identify:

- the quantity and characteristics of the waste,
- the locations of waste releases,
- the fate of the waste constituents,
- the effects on yields of harvestable species, and
- the body burden of contaminants in harvestable species.

Table III-4 details the parts of a monitoring program and the parties responsible for each part. An important component omitted from the cost estimate described in Table III-4 is waste characteristics monitoring. This monitoring, which must be done by the permittee, is now done quarterly on conventional pollutants, heavy metals and selected other contaminants.

Surveillance is necessary to ensure that ocean disposal vessels discharge their cargoes at the proper site at a rate which will not exceed the limiting permissible concentration (LPC) required by the permit. The surveillance system which will be required has not been determined but surveillance could be achieved using the following three different systems:

- ship riders
- black box navigational systems
- examination of ship logs

Ship riders are on-board Coast Guard inspectors who ensure proper disposal procedures are followed. This surveillance approach requires the largest Coast Guard expense because a ship rider would be necessary for each voyage. If riders are assigned only to selected vessels to save money, there is no way to enforce proper procedures on voyages lacking ship riders. The Coast Guard would probably need to assign two or three ship riders to each of the vessels engaged in sludge disposal to achieve complete coverage.

Table III-4. Overall monitoring program for 106-mile site

Type of monitoring	Sampling location and time scale	Purpose	Conducting parties
Compliance Monitoring	Disposal site; up to 5 hrs. after disposal operation	To assure compliance with permit conditions and LPC	Permittee, EPA
Near-field Monitoring	Disposal site; at least 24 hours after disposal operations	Monitor immediate and short-term impacts; follow dispersion and diffusion characteristics of wastes; dump site management, including cumulative impacts	Permittee; EPA; NOAA
Far-field Monitoring	Wide geographic area; long-term, periodic sampling	Determine movement of waste constituents; dump site management, including cumulative impacts	EPA; NOAA
Marine Resources Monitoring	Wide geographic area; long-term, periodic sampling	Determine long-range impacts and trends associated with health/availability of marine resources	NOAA
Ocean Process	Wide geographic area; long-term, periodic sampling	Monitor progressive changes in physical, chemical, biological characteristics	NOAA

Source: Criteria and Standards, EPA.

The black box system relies on a shore-based transponder that allows the Coast Guard to monitor continuously the vessel's position. Black boxes have two advantages over ship riders. First, they are less costly. Second, it is impossible for the vessel operators to know whether they are being monitored. The chief disadvantage of the black box is the need for transponders on each vessel in the ocean disposal fleet.

Ship log audits are the simplest and cheapest surveillance method. This system relies on the requirement that vessels record their movements in a log indicating arrivals and departures at each point in the voyage. Even though vessel operators can falsify the logs, it is possible to verify them from POTW logs and independent sightings of other vessels. The audit trail can easily be traced because the time for each leg of a voyage is fairly constant.

B. Number of Users

Each sewerage authority treats the wastes of several local municipalities as presented in Table III-5. The number of municipalities ranges from five in Nassau County to forty-three in Bergen County. The municipalities provide local sewer hook-ups, collection and transport to the sewerage authority trunk lines. Approximately ten million residents and 300 municipalities are served by the eight sewerage authorities shown in Table III-5. The New York City sewerage authority serves nearly half of this total with 5.3 million residential users. Nassau County serves 889,000 residents, while Westchester County has 484,000 residential users. Westchester County also has over one thousand commercial users.

In New Jersey, the Passaic Valley sewerage authority serves the largest number of residential and commercial users. Five thousand commercial users and 1.3 million residential users utilize services offered by the Passaic Valley sewerage authority. The number of Bergen County commercial users was not available, but there are 476,000 residential users. Middlesex County is second to Passaic Valley in the number of residential users served, at 609,000. The Middlesex County sewerage authority also has 1,300 commercial users. The Linden/Roselle/Rahway sewerage authority has the least number of residential users, at 279,000. However, it serves the second largest number of commercial users, at 2,973. Joint Meeting has 459,000 residential users and 1,626 commercial users.

C. Community Demographics

Demographic data for the communities in which the sewerage authorities are located are summarized below. Information was not always available for the specific populations served by two sewerage authorities, Joint Meeting and Linden/Roselle/Rahway. Therefore, it was necessary to rely on county data for these sewerage authorities. The Linden/Roselle/Rahway authority is located in Union County and segments of both Union County and Essex County are served by the Joint Meeting sewerage authority. Data for these two counties are included in the text and tables of this section to represent the pertinent sewerage authorities.

Table III-5. Number of municipalities, residential and commercial users, 1982

Sewerage authority	Municipalities served	Residential users	Households	Commercial and industrial users	Significant industrial users
		(thousands)			
NEW YORK					
New York City	NA	5,302	624	NA	NA
Nassau County	5	889	320	1,640	200
Westchester County	9	484	156	1,192	75
NEW JERSEY					
Bergen County	43	476	145	NA	15
Passaic Valley	29	1,300	433	5,000	355
Middlesex County	21	609	203	1,300	110
Linden/Roselle/Rahway	3	279	85	2,973	140
Joint Meeting	12	459	188	1,626	NA
Total of all sewerage authorities	NA	9,798	2,154	NA	NA

NA = Not available.
Source: DPRA site visits to the eight sewerage authorities January 1984.

Demographic data were collected from U.S. Census Bureau publications, specifically U.S. County Business Patterns and General Social and Economic Characteristics.

1. Population

The total population for each county and New York City is shown on Table III-6. As noted on the table, only one county experienced an increase in population between 1970 and 1980. The population of Middlesex County increased 2.1 percent. New York City suffered the largest decline in population from 1970 to 1980 at 10.4 percent.

2. Annual Income

A comparison of the median household income in each county is shown on Table III-7. Nassau County had the highest median household income in 1979 at $26,090. The lowest median income was $13,854 for households in New York City.

Fifty-three percent of the households in New York City had an annual income of less than $15,000. New York City also reported the highest percentage of families below the poverty level at 17.2 percent. In comparison, Bergen County reported that only 3.1 percent of its families were below the poverty level and only 28 percent of the households in the county had an annual income of less than $15,000.

Per capita income is also shown on Table III-7, and ranges from $7,214 in Passaic County to $10,603 in Westchester County.

3. Employment

The total number of persons employed, the total annual payroll and the unemployment rate for New York City and the relevant counties are shown on Table III-8. Passaic County experienced the highest unemployment rate in 1982 at 11.0 percent, which was 1.3 percent higher than the U.S. unemployment rate of 9.7 percent. Westchester County experienced the lowest unemployment rate of the counties shown on the table at 5.4 percent in 1982.

The number of persons employed in each county during 1980 ranged from 166,000 in Passaic County to 2.9 million in New York City.

4. Sales and Value of Shipments

Retail sales and value of shipments in 1977 are shown below for New York City as well as the counties which contain the sewerage authorities studied in this report.

Table III-6. Total population

County or city	1970	1980	% change
NEW YORK			
New York City	7,894,862	7,071,639	-10.4
Nassau County	1,428,080	1,321,582	-7.5
Westchester County	894,104	866,599	-3.1
NEW JERSEY			
Bergen County	898,012	845,385	-5.9
Passaic County	460,782	447,585	-2.9
Middlesex County	583,813	595,893	2.1
Essex County	929,986	851,116	-8.5
Union County	543,116	504,094	-7.2
Total	13,632,755	12,503,893	-8.3

Source: U.S. Department of Commerce, Bureau of the Census. General Social and Economic Characteristics, 1980. 1983 (July).

Table III-7. Annual income in 1979

County or city	Median household income	Less than $15,000	$15,000 to $24,999	$25,000 to $49,999	$50,000 Plus	Per capita income	Percent of families below poverty level
		----------(thousands of households)--------				($)	
NEW YORK							
New York City	$13,854	1,485	650	537	120	7,271	17.2
Nassau County	26,090	100	100	167	57	9,974	3.6
Westchester County	22,725	97	70	98	43	10,603	5.6
NEW JERSEY							
Bergen County	24,053	83	73	109	35	10,188	3.1
Passaic County	17,907	64	41	41	7	7,214	10.5
Middlesex County	22,826	56	54	74	13	8,357	4.7
Essex County	16,186	140	69	71	20	7,538	15.2
Union County	21,625	59	44	59	15	9,031	5.8
Total		2,084	1,101	1,156	310		

Source: U.S. Department of Commerce, Bureau of the Census. General Social and Economic Characteristics, 1980. 1983 (July).

Table III-8. Employment statistics

City or county	Total number of persons employed in 1980 1/	Total annual payroll in 1981 2/	Percent unemployment in 1982 3/
	(1,000)	($1,000,000)	
NEW YORK			
New York City	2,918	NA	9.6
Nassau County	458	6,975	6.0
Westchester County	316	5,371	5.4
NEW JERSEY			
Bergen County	358	5,985	6.9
Passaic County	166	2,601	11.0
Middlesex County	238	4,180	8.0
Essex County	323	5,520	9.8
Union County	232	4,229	9.3
Total	5,009	NA	

1/ Source: U.S. Department of Commerce, Bureau of the Census. General Social and Economic Characteristics, 1980. 1983 (July).

2/ Source: U.S. Department of Commerce, Bureau of the Census. County Business Patterns, 1981. 1983 (April).

3/ Source: Telephone conversation with George Abraham, Bureau of Labor Statistics. (202) 523-1002.

Retail sales and manufacturing value of shipments in 1977

NEW YORK	Retail Sales 1/ (billions of dollars)	Manufacturing value of shipments 2/ (billions of dollars)
New York City	17.2	42.4
Nassau County	5.4	4.8
Westchester County	3.1	3.8
NEW JERSEY		
Bergen County	3.5	6.5
Passaic County	1.5 3/	3.2
Middlesex County	1.9 4/	6.9
Essex County	2.4	4.8
Union County	1.7	8.9

5. Municipal Bond Ratings

Standard and Poor's was examined for municipal bond ratings of the counties and cities containing the sewerage authorities examined in this report. The bond ratings are used as a screening tool for evaluation of economic impacts on communities due to increased capital costs. Funds from the bonds are used to pay the cost of any part of the sewerage systems or to refund outstanding bonds. Bond indebtedness ranged from $10 million at Rahway Valley to $68 million at Middlesex. The rating system used by Standard and Poor's is shown below, and is taken directly from the October 1983 Standard and Poor's Bond Guide.

AAA - Bonds rated AAA have the highest rating assigned by Standard and Poor's. Capacity to pay interest and repay principal is extremely strong.

AA - Bonds rated AA have a very strong capacity to pay interest and repay principal and differs from the higher rated issues only in small degree.

A - Bonds rated A have a strong capacity to pay interest and repay principal although it is somewhat more susceptible to the adverse effects of changes in circumstances and economic conditions than bonds in higher rated categories.

1/ Source: U.S. Department of Commerce, Bureau of the Census. 1977 Census of Retail Trade, Geographic Area Statistics. 1980 (March).
2/ Source: U.S. Department of Commerce, Bureau of the Census. 1977 Census of Manufactures, Geographic Area Statistics. 1981 (August).
3/ Coextensive with Paterson-Clifton-Passaic, New Jersey, SMSA.
4/ Coextensive with New Brunswick-Perth Amboy-Sayreville, New Jersey, SMSA.

BBB - Bonds rated BBB are regarded as having an adequate capacity to pay interest and repay principal. Whereas they normally exhibit adequate protection parameters, adverse economic conditions or changing circumstances are more likely to lead to a weakened capacity to pay interest and repay principal for bonds in this category than for bonds in higher rated categories.

Plus (+) or Minus (-): The ratings from "AA" to "B" may be modified by the addition of a plus or minus sign to show relative standing with the major rating categories.

Standard and Poor's ratings are based on three considerations.

1. Likelihood of default-capacity and willingness of the obligor as to the timely payment of interest and repayment of principal in accordance with the terms of the obligation;

2. Nature of and provisions of the obligation;

3. Protection afforded by and relative position of the obligation in the event of bankruptcy, reorganization or other arrangement under the laws of bankruptcy and other laws affecting creditors' rights.

Pertinent municipal bond ratings are summarized below by county.

New York City revenue bonds for the Metropolitan Transportation Authority have an overall rating of AAA from Standard and Poor's. The triple A rating indicates an extremely strong capacity to pay interest and repay principal. Although this rating does not correspond to sewerage authority bond ratings, it was the only one available for the city of New York.

Nassau County general obligation and revenue bond ratings also have an overall rating of AAA.

Westchester County's general obligation municipal bond has a Standard and Poor's rating of AA+. The Westchester County revenue bond which was issued 10-1-82 (Serial A), was assigned an AAA rating. Another Westchester County bond which was issued in 1982 for Resource Recovery has a provisional rating of A. The provisional rating assumes the successful completion of the project being financed.

Bergen County sewer authority municipal revenue bonds have an overall rating of AAA. The bonds issued in 1978 by the Utility Authority have an AAA rating for the Special Obligation issue and an A+ rating for the Refunding issue.

Passaic Valley sewer authority revenue bonds which were issued in 1972 and 1977, have an A rating from Standard and Poor's.

Linden/Roselle/Rahway Valley sewerage authority revenue bonds have an AAA rating for those bonds issued in 1970 and 1976. Rahway Valley revenue bonds issued in 1980 have a Standard and Poor's rating of A. General obligation bonds for Linden have an AA rating.

Essex County vocational school general municipal bonds have a Standard and Poor's rating of AA. Essex county is part of the Joint Meeting sewerage authority.

Union County general obligation bonds have an AA+ rating from Standard and Poor's. Union county is part of the Joint Meeting sewerage authority.

Middlesex County general obligation bonds have a Standard and Poor's rating of AA, while the Middlesex County sewerage authority revenue bond has an A rating.

IV. OCEAN DISPOSAL COSTS

A. Background

This chapter reviews the development of ocean disposal costs incurred by New York and New Jersey sewerage authorities that were used in the economic impact analysis. In this chapter, the key parts of the methodology and the important assumptions are reviewed. The costs used in the economic impact analysis are then presented.

B. Methodology and Assumptions

The methodology involved simple aggregations for each sewerage authority based on its sludge generation rate and the unit cost of disposing at the 106-mile site. This chapter describes the transportation cost component of ocean disposal.

Transportation is the largest cost and would be affected the most by moving from the 12-mile to the 106-mile site. Using the 106-mile site can also increase storage costs as sludge backlogs wait for tankers or barges to return from the longer voyages. A discussion of storage costs is presented in Chapter III.

Transportation costs depend on the demand created by sludge generation and the supply provided by ocean disposal vessels. Factors on both sides of the cost determination were included in the methodology of this analysis. Sludge generation depends on several factors and projections can vary according to:

- the season of the year,
- changes in the POTW's service area in terms of square mileage or number of users,
- level or type of treatment, or
- industrial pretreatment.

The supply of ocean disposal is equally complex. First, the availability of ocean disposal facilities can depend on the size and depth of piers, pumping capabilities and the types of vessels. Second, the actual vessel supply consists of contract and city owned barges and tankers. Third, weather can be an important constraint on the supply of ocean disposal capacity. Under certain weather conditions, vessels cannot travel to the disposal site. Moreover, weather can have different effects on tankers and barges. The frequency of inclement weather varies by season, but weather delays are more common in winter. Fourth, the costs of the actual transportation include capital costs, operating and maintenance costs and fuel. Also, transportation costs must absorb the costs of loading and discharging the sludge. Discharge time can be as high as 16 hours to prevent exceeding the limiting permissible concentration.

The ocean dumping vessels in the study area can be classified into three types:

- vessels owned by the sewerage authorities
- large ocean-going barges operated by A&S Transportation, Inc.
- small tankers operated by General Marine Transport.

The ownership and operating arrangements between the fleet and the sewerage authorities are summarized in matrix form in Table IV-1 for 1982. Changes in these contractual arrangements have been reported for 1983 and 1984. New York City has its own tankers and Westchester County has its own barge but all of the sewerage authorities utilize contractors for sludge disposal. A&S Transportation serves all the sewerage authorities.

The amount of tanker or barge capacity depends on the vessel payload and the number of trips it can make. Tables IV-2 and IV-3 summarize the annual vessel capacities for tankers and barges, respectively. Annual capacities assume a full utilization of 64 percent for tankers and 50 percent for barges.

In Table IV-4, the capacity of the ocean dumping fleet is compared to the sludge generation rates of the various sewerage authorities. Maximum capacity is calculated based on the actual payload of the vessels available to a sewerage authority and the number of trips they can make to the particular disposal site each year. New York City is listed separately and the other sewerage authorities are grouped according to whether they use contract tankers or their own barges. The capacities of all three types of transports are inadequate to meet the demand for ocean dumping at the 106-mile site. The shortfalls at this level of utilization will range from 23 percent of generated sludge for New York City to over 40 percent for Nassau and Bergen counties, which rely on tankers.

The methodology of this analysis assumes that any shortfall of capacity due to moving to the 106-mile site will be made up by the transporters at a competitive price and will cost the sewerage authorities the same on a per ton of sludge basis as the existing fleet. Thus, the shortfall will not raise prices.

C. Disposal Costs

The estimated costs of ocean disposal are the basis of the economic impact analysis summarized in the following chapter. Transportation costs were estimated from capital costs and operating and maintenance costs of vessels obtained from transporters. Costs for each sewerage authority were developed according to the type of vessels that serve it. The number of

Table IV-1. Contractual arrangements of vessels permitted to dump POTW sludge

Operator:	City of New York				Ocean Disposal, Inc.	A&S Transportation					General Marine			Westchester County
Vessel:	Newtown Creek	Bowery Bay	North River	Owl's Head	Ocean* Disposal #1	Kimberly Ann	Lisa	Veronica Evelyn	Dina Marie	Maria	Susan Frank	Rebecca K	Leo Frank	Westco
Type:	(T)	(T)	(T)	(T)	(B)	(B)	(B)	(B)	(B)	(B)	(T)	(T)	(B)	(B)
<u>User</u>														
New York City Sludge	X	X	X	X	X	X	X	X	X	X	X	X	X	
Digester Cleanout (106-mile site)					X	X	X	X	X		X	X	X	
Nassau County											X	X	X	
Westchester County											X	X	X	X
Passaic Valley					X	X	X	X	X	X				
Bergen County Sludge											X	X	X	
Digester Cleanout (106-mile site)					X	X	X	X	X	X	X	X	X	
Linden Roselle					X	X	X	X	X	X				
Joint Meeting					X	X	X	X	X	X				
Middlesex County					X	X	X	X	X	X				

Key: B = Barge
T = Tanker
* Listed as owned by Week Stevedoring Inc.

Source: TBS 1982

Table IV-2. Availability of tanker capacity for dumping at the 12- and 106-mile sites

Operator and tanker	106-Mile site			12-Mile site		
	Tanker payload (ton)	Average Number of trips per year 64%	Thousand tons of sludge per year 64%	Payload (tons)	Average number of trips per year 64%	Thousand tons of sludge per year 64%
New York City						
Newton Creek	3,400	282	958	3,400	603	2,050
Bowery Bay	2,100	132	277	2,100	477	1,002
North River	3,400	132	277	3,400	603	2,050
Owl's Head	2,100	132	277	2,100	477	1,002
TOTAL PER YEAR		828	2,470		2,160	6,104
TOTAL PER QUARTER		207	618		540	1,526
General Marine (Nassau and Bergen Counties)						
Rebecca K	1,600	125	200	1,600	386	618
Susan Frank	1,600a	120	200	1,600	386	618
TOTAL PER YEAR		1,076	400		772	1,236
TOTAL PER QUARTER		269	100		193	309

Source: TBS 1982, Abt Associates, Inc.

Table IV-3. Availability of barge capacity for dumping at the 12- and 106-mile sites

Operator and tanker	106-Mile site			12-Mile site		
	Tanker payload (ton)%	Average Number of trips per year 50%	Thousand tons of sludge per year 50%	Payload (tons)	Average number of trips per year 50%	Thousand tons of sludge per year 50%
Modern (A&S) Transportation						
Maria	8,000	65	520	8,000	160	1,280
Kimberly Ann	8,000	65	520	8,000	160	1,280
Lisa	8,000	65	520	8,000	160	1,280
Veronica Evelyn	3,000	65	195	3,000	160	480
Dina Marie	3,000	65	195	3,000	160	480
Ocean Disposal	5,900	65	520	5,900	160	944
General Marine						
Leo Frank	5,740	65	373	5,740	160	918
Laurie B	5,740 a/	65	373	5,740	160	918
Lindsey Frank	5,740 a/	65	373	5,740	160	918
Westchester County						
Westco	--	--	--	1,600	155	248
TOTAL PER YEAR		500	3,453		1,435	7,802
TOTAL PER QUARTER		128	863		359	1,951

a/ Laurie B and Lindsey Frank are former industrial waste disposal vessels recently acquired by General Marine, capacity assumed to be same as Leo Frank.

Source: TBS 1982, Abt Associates, Inc.

Table IV-4. Demand and supply for ocean dumping capacity at the 106-mile site

	New York City	Communities using contract tankers 1/	Communities using barges 2/
	(000 wet tons)		
Sludge Generation			
Current			
Annual	3,206	702	3,659
Maximum Quarter	n.a.	205	1,175
Fleet Capacity			
Annual	2,470	400	3,453
Quarterly	618	100	863

1/ Bergen and Nassau counties.

2/ Passaic Valley, Middlesex, Joint Meeting, Linden/Roselle/Rahway, Westchester County.

Source: Abt Associates, Inc.

voyages a vessel can make in a year was calculated based on round trip distance, vessel speed and total voyage time. The total annual cost is based on the vessel's capital cost and its semi-fixed and variable costs. Total annual sludge quantities that can be transported are the product of vessel payload and the number of trips. Total annual cost of the vessel is divided by total annual sludge quantity to calculate cost per ton. A 15 percent contractor fee or profit is added to this cost per ton to arrive at the cost to the sewerage authority.

The costs for each sewerage authority in the study area are presented in Table IV-5. They are based on the sludge generation rates and the unit disposal cost. These costs do not include storage costs.

1. New York City

The total annual cost for New York City of disposal at the 106-mile site is estimated to be $14.9 million, based on a unit disposal cost of $4.64 per wet ton and an annual sludge quantity of 3.2 million wet tons.

Sludge disposal for New York City is considered to be the most complex of the sewerage authorities. New York City accounts for the largest percentage of the total sludge disposed of at the 106-mile site. Moreover, this sludge is generated at 11 different plants. Under current sludge generation rates and capacity constraints, New York will need to make up its shortfall with contract transporters. The cost of this mix of city-owned and contract disposal is summarized in detail in Table IV-6.

2. Nassau County

The estimated cost of ocean disposal at the 106-mile site for Nassau County is $3.3 million, based on a unit disposal cost of $7.41 and an annual sludge quantity of 441 thousand wet tons.

3. Westchester County

The estimated disposal cost for Westchester County is $3.6 million, based on a unit disposal cost of $8.21 per wet ton and annual sludge quantity of 433 thousand wet tons.

This is the third highest total ocean disposal cost for any sewerage authority in the study area. Most of this cost is the result of Westchester County's high unit disposal cost. One reason for this unit cost is the county's use of a small county-owned barge and two commercial tankers. Its use of larger, more economical barges is limited by pier size and depth. Another reason for the high unit cost is Westchester County's location, which gives its sludge haulers the longest round trip.

Table IV-5. Cost of sludge disposal for New York and New Jersey sewerage authorities at the 106-mile site (assuming no dewatering)

	New York City	Nassau	Westchester	Bergen	Passaic Valley	Middlesex	Linden/ Roselle/ Rahway	Joint Meeting	Total
Wet Tons of Sludge (000)									
Actual 1982	3,206	441	433	289	1,694	820	269	421	7,573
Unit Cost (dollars per wet tons)	4.64	7.41	8.21	7.88	4.50	3.85	3.82	3.69	5.07
Total Cost (000 dollars)	14,880	3,266	3,555	2,277	7,623	3,159	1,027	1,554	37,341

Source: Abt Associates, Inc.

Table IV-6. Summary of cost of sludge disposal for New York City

Disposal method	Volume	Cost per wet ton	Total cost
	(000 wet tons)	($)	(000 dollars)
City Tankers			
3,400 ton tanker	1,916	3.01	4,767
2,150 ton tanker	554	6.32	3,501
Total	2,470	3.75	9,268
Contractor disposal	736	7.62	3,510
TOTAL	3,206	4.64	14,880

Source: Abt Associates, Inc.

4. Bergen County

The cost of ocean disposal at the 106-mile site for Bergen County is estimated at $2.3 million, based on a unit disposal cost of $7.88 per wet ton and annual sludge generation of 289 thousand wet tons.

Bergen County's costs are relatively high because it has the second highest unit disposal costs of any sewerage authority. This high unit cost reflects a relatively long round trip to the disposal site and the county's reliance on contract tankers of General Marine transport. Bergen County cannot load lower cost barges at its pier under normal circumstances.

5. Passaic Valley Sewerage Authority

The estimated total cost of ocean disposal for Passaic Valley is $7.6 million, based on a unit cost of $4.50 per wet ton and annual sludge generation of 1.69 million wet tons. Except for New York City, this is the highest ocean disposal cost incurred by any sewerage authority. The high total cost is attributable to the large amount of sludge generated by Passaic Valley. Only New York City generates more. The estimated cost assumes that Passaic Valley is not yet able to dewater its sludge to 10 percent solids and thus generates the larger amount of sludge.

6. Middlesex County

The cost of ocean disposal at the 106-mile site for Middlesex County is estimated to be $3.2 million, based on a unit disposal cost of $3.85 per wet ton and annual sludge generation of 820 thousand wet tons. Middlesex County has a relatively low unit cost because of its short round trip to the disposal site.

7. Linden/Roselle/Rahway Sewerage Authority

The estimated cost of ocean disposal for Linden/Roselle/Rahway is slightly over $1.0 million, based on a unit disposal cost of $3.82 per wet ton and annual sludge generation of 269 thousand wet tons.

8. Joint Meeting (Essex and Union Counties)

The total cost of ocean disposal for Joint Meeting is an estimated $1.6 million, based on a unit disposal cost of $3.69 per wet ton and annual sludge generation of 421 thousand wet tons.

Joint Meeting has the lowest unit disposal cost of any sewerage authority. This results primarily from its use of low-cost barges for sludge hauling and its short round trip to the disposal site.

D. Incremental Ocean Disposal Costs

The estimated incremental costs to each sewerage authority of moving to the 106-mile site are calculated by subtracting the total cost of the 12-mile site from the total cost of the 106-mile site. The total cost of the 12-mile site is based on the 12-mile unit cost and the 1982 sludge generation rate of the sewerage authority. These data and the incremental costs are summarized in Table IV-7. Several sewerage authorities reported a reduction in current (1983-1984) contract costs with transporters. These costs are shown below along with the 1982 cost presented in Table IV-7.

	1983-1984	1982
	------$ per wet ton-----	
Middlesex County	1.21	2.43
Linden/Roselle/Rahway	1.14	2.54
Joint Meeting	1.39	1.66

Westchester County reported an increase in sludge disposal costs in 1983 to $1.81 per wet ton from $1.41 per wet ton.

The estimated incremental costs shown in Table IV-7 range from $344,000 for Linden/Roselle/Rahway up to $11.3 million for New York City. Passaic Valley and Nassau County incur the next highest incremental costs of $5.4 million and $2.6 million, respectively. Joint Meeting is the only other sewerage authority incurring an incremental cost less than $1 million.

Table IV-7. Incremental costs of moving from the 12-mile site to the 106-mile site

Sewerage authority	12-Mile unit cost ($)	Sludge volume ($000)	12-Mile total cost ($000)	106-Mile total cost ($000)	Incremental cost ($000)
New York					
New York City	1.11	3,206	3,559	14,880	11,321
Nassau County	1.41	441	622	3,266	2,644
Westchester County	5.38	433	2,330	3,555	1,225
New Jersey					
Bergen County	2.74	289	792	2,277	1,485
Passaic Valley	1.32	1,694	2,236	7,623	5,387
Middlesex County	2.43	820	1,993	3,159	1,166
Linden/Roselle/Rahway	2.54	269	683	1,027	344
Joint Meeting	1.66	421	699	1,554	855

Source: Abt Associates, Inc.

V. ECONOMIC IMPACTS

The economic impacts of shifting disposal options from the 12-mile site to the 106-mile ocean disposal site are presented in this chapter. Basically, the economic effects are measured by comparison of the incremental cost to transport sewage sludge to the 106-mile site with community baseline costs. The methodology used is presented in more detail in Chapter II.

As with the presentation of sewerage authority profiles and ocean disposal costs, the base year of 1982 was used to depict baseline conditions. The variables such as sludge quantities are constantly changing but the quality of data does not warrant more sophisticated dynamic models. Over the past three years the proposed alternative for disposal of sewage sludge has changed each year. As of 1982, the treatment systems operated by each sewerage authority were stable and preliminary sludge quantities for 1983 are similar to the 1982 reported amounts. It is not expected that sludge quantities will increase in the future. New York City is the only sewerage authority that has not completed construction of all secondary treatment facilities.

Baseline information is presented in the next section for each sewerage authority. The estimates of impacts on residential users and industrial users are then presented. A capital availability assessment is also made.

A. Community Baseline Conditions

Table V-1 shows the annual baseline costs to operate the eight sewerage authorities. Total annual baseline costs range from $5.6 million for Joint Meeting to $55.1 million for New York City. Annual baseline costs include costs to dispose of sludge at the 12-mile site. The total baseline costs for all eight sewerage authorities is $164 million. In Table V-1 annual baseline costs are allocated to residential users and industrial users groups. Residential costs account for approximately 75 percent of the total baseline costs and industrial costs account for the remaining 25 percent for all sewerage authorities. Linden/Roselle/Rahway has the highest proportion of industrial costs at 40 percent. Each sewerage authority defines commercial users differently so for comparison purposes commercial users have been included in the industrial users group.

The baseline sewage treatment costs include all charges by sewerage authorities to municipalities served. Each municipality incurs additional sewer collection system maintenance costs to provide sewer service to the consumer. The magnitutde of this cost depends on where the municipality hooks up to the sewerage authority trunk line and on the number, location, and types of users served. The sewerage authorities base the charge to municipalities on metered water usage and pollutant loadings. For this purpose, each sewerage authority has developed user formulas by category of

Table V-1. Annual operating and maintenance and debt service costs by sewerage authority 1/

Sewerage authority	Residential users allocation	Industrial users allocation	Total baseline costs
	(thousand dollars)		
NEW YORK			
New York City	40,100	14,974	55,074
Nassau County	17,140	2,337	19,477
Westchester County	8,883	1,098	9,981
NEW JERSEY			
Bergen County	11,147	384	11,531
Passaic Valley	24,108	13,044	37,152
Middlesex County	11,109	6,590	17,699
Linden/Roselle/Rahway	4,593	3,013	7,606
Joint Meeting	4,350	1,294	5,644
Total	121,430	42,734	164,164

1/ 1982 dollars

Source: DPRA site visits to the eight sewerage authorities January 1984.

users (residential, commercial, and industrial). However, the municipalities charge users usually on an ad valorem or frontage length basis which makes the determination of actual sewage charges to the consumer difficult. The actual cost per household could vary from the estimated cost due to these differences. Baseline costs presented in Table V-1 and used in the subsequent analysis are based on sewerage authority charges to the municipalities.

Additional baseline data from Chapter III has been summarized in Table V-2 to facilitate evaluation of economic effects. The number of residential users is shown and ranges from 279,000 in Linden/Roselle/Rahway to 5.3 million in New York City. Median incomes for households in the communities varies from $13,854 in New York City to $26,090 in Nassau County. New York City also has the highest percent of its population below the poverty level at 17.2 percent. The number of commercial and industrial users ranges from 1,192 in Westchester County to 5,000 in Passaic Valley.

Comparisons of the total baseline sewage costs with the current 12-mile site charges are presented in Table V-3. In Westchester County the transport of sludge to the 12-mile site is 23 percent of the total baseline cost. Nassau County costs to transport to the 12-mile site are the least in comparison to total baseline cost at 3 percent. Capital costs for each facility are subsidized by the federal construction grants program, which reduces other costs to the facilities while sludge transport is not subsidized.

B. Effects on Residential Users

A general measure of residential and industrial impacts can be determined by estimating the overall cost increase due to the proposed 106-mile site designation. Table V-4 presents the percent cost increase to all users when costs to the 106-mile site are added. To summarize, the community of New York City will experience the largest percent cost increase at 21 percent followed by Joint Meeting at 15 percent. Linden/Roselle/Rahway only shows a 4 percent increase in costs. The average cost increase for all sewerage authorities is 15 percent.

A more specific measure of residential impacts can be calculated using the annual cost for residential users and dividing by the number of users. The incremental cost increase to residential users in each sewerage authority is based on the baseline cost proportions shown in Table V-1. This method assumes that cost increase will be passed back to the users. Table V-5 shows the results of this computation for each sewerage authority. The average annual sewage cost will increase to $69.75 from $59.59 for the residential user. The economic effects as measured by the indicators presented in Chapter II are shown in Table V-6. Briefly, if the annual cost is over $200 per household or the user cost per median income is over 1 percent an impact is reported. The average annual cost of $69.75 is below the $200 threshold and at 0.5 percent of median income is below the 1 percent threshold. Based on this analysis a low economic impact is expected for residential users due to designation of the 106-mile site. The economic effects experienced by each sewerage authority are presented below.

Table V-2. Demographics of sewerage authority users

Sewerage authority	Residential users	House-holds	Median income (1979)	Percent below poverty level (1979)	Number of commercial and industrial users	Significant industrial users
	-------(thousands)-----		($)	(%)		
NEW YORK						
New York City	5,302	624	13,854	17.2	NA	NA
Nassau County	889	320	26,090	3.6	1,640 est.	200
Westchester County	484	156	22,725	5.6	1,192	75
NEW JERSEY						
Bergen County	476	145	24,053	3.1	NA	15
Passaic Valley	1,300	433	17,907	10.5	5,000	355
Middlesex County	609	203	22,826	4.7	1,300	110
Linden/Roselle/Rahway	279	85	21,061	6.0	2,973	140
Joint Meeting	459	188	18,207 1/	6.8	1,626	NA
Total	9,798	2,154	--	--	NA	NA
Weighted Average	--	--	19,325	12.2	--	--

NA = Not Available.
1/ DPRA estimates from Table III-6 includes Essex and Union counties.
Sources: U.S. Census Bureau and JRB Associates.

Table V-3. Comparison of total baseline costs and baseline sludge transport costs at the 12-mile site 1/

Sewerage authority	Total baseline cost	12-mile baseline transport cost	12-mile cost as a percent of total baseline cost
	------(thousand	dollars)-----	(%)
NEW YORK			
New York City	55,074	3,559	6
Nassau County	19,477	622	3
Westchester County	9,981	2,330	23
NEW JERSEY			
Bergen County	11,531	792	7
Passaic Valley	37,152	2,236	6
Middlesex County	17,699	1,993	11
Linden/Roselle/Rahway	7,606	683	9
Joint Meeting	5,644	699	12
Total	164,164	12,914	8

1/ 1982 dollars.
Source: DPRA.

Table V-4. Percent cost increase for each sewerage authority at the 106-mile site

Sewerage authority	Total baseline cost	Incremental 106-mile cost	Percent cost increase
	-----(thousand	dollars)------	(%)
NEW YORK			
New York City	55,074	11,321	21
Nassau County	19,477	2,644	13
Westchester County	9,981	1,225	12
NEW JERSEY			
Bergen County	11,531	1,485	13
Passaic Valley	37,152	5,387	14
Middlesex County	17,699	1,166	7
Linden/Roselle/Rahway	7,606	344	4
Joint Meeting	5,644	855	15
Total	164,164	24,427	15

Source: DPRA.

Table V-5. Annual baseline and incremental cost per household

Sewerage authority	Annual baseline cost	Incremental cost	Total annual cost per user
	------------------$ per household	----------------	----------------
NEW YORK			
New York City	64.26	13.21	77.47
Nassau County	53.56	7.27	60.83
Westchester County	56.94	6.99	63.93
NEW JERSEY			
Bergen County	76.88	9.90	86.78
Passaic County	55.68	8.00	63.68
Middlesex County	54.72	3.61	58.33
Linden/Roselle/Rahway	54.03	2.44	56.47
Joint Meeting	23.13	3.51	26.65
Weighted Average	59.59	10.16	69.75

Source: DPRA.

Table V-6. Summary of economic effects on residential users due to redesignation of the 106-mile site

Sewerage authority	Annual cost (debt service & O&M) per household	User cost / Median income
	(threshold $200)	(threshold 1 percent)
NEW YORK		
New York City	77.47	.6
Nassau County	60.83	.2
Westchester County	63.93	.3
NEW JERSEY		
Bergen County	86.78	.4
Passaic Valley	63.68	.4
Middlesex County	58.33	.3
Linden/Roselle/Rahway	56.47	.3
Joint Meeting	26.65	.1
Weighted Average	69.75	.5

Source: DPRA.

1. New York City

The annual cost per household in New York City will increase from $64.26 to $77.47 as shown in Table V-5. This is the highest per household increase shown for all the sewerage authorities. New York City also has the highest average number of persons per household at eight persons. The average number of persons per household for the other sewerage authorities ranges from three to four persons. Table V-6 shows that the $77.47 per household is below the $200 threshold or indicator of impacts. The user cost per median income indicator of 0.6 percent is also below the 1 percent threshold for this indicator. However, this indicator is closer to the threshold than for the other authorities. A low median income in New York City partially accounts for the reason this measure is high. The economic impact of the designation of the 106-mile site is the highest for New York City, compared to the other sewerage authorities. At a household income of $7,747 or less, the user cost per median income indicator would surpass the 1 percent threshold.

2. Nassau County

Table V-5 shows that cost per household in Nassau County will increase from $53.56 to $60.83. This cost is in the middle of other authorities' costs. The annual cost of $60.83 is below the $200 threshold and the 0.2 percent indicator is below the 1 percent threshold as shown in Table V-6.

3. Westchester County

Westchester County annual costs (shown in Table V-5) are expected to increase to $63.93 from $56.94 due to the 106-mile site designation. Table V-6 shows that both indicators are below the economic effect threshold. The user cost per median income indicator is 0.3 percent.

4. Bergen County

Table V-5 shows high baseline costs and thus high total annual costs after adding the incremental 106-mile site cost for Bergen County. The $86.78 annual cost per household which is the highest for all sewerage authorities is below the $200 threshold. Also the 0.4 percent indicator is below the threshold.

5. Passaic County

Table V-5 shows an increase in annual cost per household from $55.68 to $63.68. Both indicators are below the threshold.

6. Middlesex County

Residential users in Middlesex County will experience an increase to $58.33 per year for sewage disposal from $54.72 (see Table V-5). This increased cost is below the $200 threshold. The user cost per median income indicator is 0.3 percent.

7. Linden/Roselle/Rahway

A cost increase to $56.47 per year from $54.03 per year is estimated for Linden/Roselle/Rahway in Table V-5. Both economic indicators shown in Table V-6 are below the threshold.

8. Joint Meeting

Joint Meeting shows the lowest cost of all sewerage authorities in Table V-5. The user cost per median income indicator is 0.1 percent or ten times less than the threshold.

C. Effects on Industrial Users

Because only limited data is available on industrial users' baseline costs, it is assumed the percent cost increases experienced by this user group will be similar to the estimate of cost increases for all users presented in Table V-4. This cost increase averages 15 percent. Industrial users in six of the sewerage authorities will experience sewage disposal cost increases of over 10 percent. Passaic Valley which has the most industrial users of the sewerage authorities analyzed shows a 14 percent increase. The percent price increase for moving to the 106-mile site for industrial users was estimated by comparing the city or county's manufacturing value of shipments (shown on page III-16) to the incremental ocean disposal costs for industrial users in that community. These estimates are shown below:

Sewage authority	Incremental industrial cost (millions of dollars)	Manufacturing value of shipments (millions of dollars)	Percent price increase (%)
New York City	3.1	42,400	.01
Nassau County	.3	4,800	.01
Bergen County	.04	6,500	.001
Passaic County	1.9	3,200	.06

The percent price increases shown above are low.

Case studies of economic effects due to increases in sewage fees, on individual firms in Bergen County and Middlesex County are shown in Tables V-7 and V-8, respectively. Firms in Bergen County showed a 13 percent cost increase due to the 106-mile site in Table V-4 which is represented by a $50,000 increase to the 15 industries shown in Table V-7. Individual firm costs in Bergen County increased from $240 to $21,090. Middlesex County had a 7 percent increase in cost at the 106-mile site which will increase total industry sewage costs by $460,000. Middlesex County firms experienced cost increases in sewage fees ranging from $5,000 to $146,000. Sewage fees would have to account for at least 10 percent of an individual firm's total sales before impacts would be expected in this group.

Table V-7. Bergen county estimated firm effects

Industries	1982 costs	Incremental 106-mile cost	Total cost
	----------------($)----------------		
Berg Vocational School	1,847	240	2,087
Conrail	1,298	169	1,467
Delaware Valley R. M.	249	32	281
Edax Realty	2,975	387	3,362
Fairleigh Dickinson University	7,632	992	8,624
Federated Store	20,900	2,717	23,617
N.T. Viegeman Company	5,552	722	6,274
Lier Siegler Inc.	1,210	157	1,367
Lincoln Paper Co.	87,494	11,374	98,868
Lowe Paper	77,519	10,077	87,596
Imperial Manor	3,804	495	4,299
NJ Turnpike Authority	1,258	164	1,422
Pan Am	3,234	420	3,654
Pfister CHemical	162,228	21,090	183,318
Public Service Electricity & Gas	7,135	928	8,063
Total Cost	384,335	49,964	434,299

Source: DPRA site visit to the Bergen County Utility Authority January 1984.

Table V-8. Middlesex county estimated firm effects

Industries	1982 costs	Incremental 106-mile cost	Total cost
		$ thousand	
Busch Industrial	1,485	104	1,589
Hatco and Company	192	13	205
Hercules Inc.	1,644	115	1,759
N.L. Industries	142	10	152
Schweitzer U.S.	2,084	146	2,230
Sherwin Williams	75	5	80
Stauffer Chemical	556	39	595
Superior Air Products	1	-	1
Tenneco Chemicals	164	11	175
Union Carbide	247	17	264
Total Cost	6,590	460	7,050

Source: DPRA site visit to the Middlesex Utility Authority January 1984.

D. Capital Availability

As presented in the methodology in Chapter II capital availability is assessed by using bond ratings. This screening tool is used because capital requirements are expected to be low for additional sludge storage and dewatering equipment. Land is available at each sewerage authority for some additional facilities. Dewatering, which would probably only consist of increased operating and maintenance cost, would reduce the necessity for additional sludge storage. The sewerage authorities also have made recent bond placements without incurring significantly increased costs. All of the sewerage authorities concerned have bond ratings over A, thus, capital availability is not expected to be a serious problem.

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VI. LIMITS OF THE ANALYSIS

The chapter presents the general accuracy of the study research, data availability, critical assumptions and sensitivity analysis of variables.

A. General Accuracy

The sewerage authorities studied are complex in terms of treatment processes, types of users, sludges generated and disposal methods. In this study nine different sewerage authorities were evaluated and compared. Each of the sewerage authorities was different in most aspects. Specific data was collected from each of the sewerage authorities so that these differences would be noted. The economic analysis was conducted for each sewerage authority and then aggregated. Site visits were conducted to obtain the information necessary to complete the analysis using the methodology presented.

Throughout the study an effort was made to evaluate the data available and to update these materials whenever possible. Checks were made with informed sources in both sewerage authorities and government to help insure that data were reliable and representative.

Data used in this report were collected from a wide variety of sources besides the individual sewerage authorities. Data were collected from previous EPA reports presented in the references, Region II data and information from the Construction Grants Program. Each sewerage authority had a unique set of data available describing it which had to be summarized and updated for comparison with other sewerage authorities. An example would be the inflating of sewage costs to the same base year. For most sewerage authorities actual 1982 data was available while for others 1982 data had to be estimated.

Generally data was very complete and accurate for each sewerage authority. Baseline sewerage costs were obtained from audited financial statements and checked with sewerage authority directors. Demographic data were collected from the Bureau of Census and were also checked with the individual sewerage authority to determine consistency. Overall the qualitative estimates of accuracy are presented below:

Community baseline conditions	± 10%
Estimated ocean disposal costs	± 20%
Overall accuracy	± 15%

The accuracy of this report has been enhanced by cooperation and data availability. However, the complexity of the problem is such that qualitative judgements were involved, thus, the possibility of errors exists. Such errors stemmed from a variety of sources, and collectively may have been additive or offsetting. Possible errors due to data availability and critical assumptions are discussed below. Then a sensitivity analysis of several key variables is presented.

B. Data Availability

Incremental costs to dispose of sludge at the 106-mile site were estimated since only a small amount of wastes have been disposed of at this site. Costs were estimated based on information from the various transporters and the sewerage authorities. Actual transport costs would improve the study results. Costs in 1983 and 1984 for transport of sludge have declined from the 1982 estimates used in the report. Costs may decline more as the certainity of ocean disposal regulations increases thus reducing the risk for transporters.

Better estimates of storage requirements for sludge are needed as are additional information on the technical aspects and costs of dewatering. These costs are assumed to be somewhat offsetting but the magnitude of the cost is unknown. Also, monitoring and surveillance regulations are currently being revised which may have an effect on the 106-mile site designation. These factors are not expected to be limiting variables on the economic analysis, but better information would improve the accuracy of the report.

Other data such as baseline costs, community demographics and sewerage treatment plant description were accurate and up-to-date.

C. Critical Assumptions

There are four major critical assumptions used in this analysis which may effect study results. These assumptions are discussed below.

1. Sludge quantities in 1982 are typical of future volumes - Sludge quantities have increased over the past ten years in the New York and New Jersey area but have leveled off in 1982 and 1983. Secondary treatment systems are now on-line at each of the sewerage authorities thus major increases in sludge are not expected. An increase in sludge volumes would increase the economic impacts.

2. Sludge transportation capacity will increase to meet the 106-mile site demand - Sewerage authorities and transporters reported an increase in the fleet size to handle sludge wastes after the courts approved ocean dumping. It is expected that additional transport vessels will be purchased or built by transporters to meet the 106-mile site demand. Competition among transporters could cause an oversupply of vessels.

3. Estimated transportation costs are reasonable for the period reviewed - Transportation cost data were collected from sewerage authorities and transporters. These costs may increase or decrease in the future depending on vessel capital costs and changes in operating and maintenance costs such as fuel. Costs used were reflective of 1983 conditions. The most recent contractual arrangements between transporters and sewerage authorities have shown a decline in costs which would reduce economic impacts.

4. Sewerage authorities will not dewater to reduce sludge volumes - As discussed in Chapter III dewatering could reduce sludge volumes and thus reduce transportation costs. Some sewerage authorities may chose this option depending on its cost-effectiveness. The effects of dewatering on transportation costs is presented in the next section.

D. Sensitivity Analysis

The effects of changes in estimates of transportation costs, sludge volumes and baseline sewage costs are briefly discussed in this section. Changes in these variables are not expected to effect the overall results of the analysis.

Transportation costs to the 106-mile site were estimated by the sewerage authorities to total $52 million instead of the $37 million used in this analysis. This estimate by the sewerage authorities was made in 1981 and was based on estimates from transporters. Since 1981, actual transportation costs have declined partly due to decreased risk or uncertainty in the ocean disposal regulations. Other differences can be explained by sludge volume changes and estimates of capacity utilization. Some of the authority estimates were made over the telephone without detailed analysis. Still, the transportation costs used would vary around the $37 million estimate.

Changes in the type of treatment used by the POTW's could affect sludge volume estimates significantly. Sludge volumes from New York City could be reduced by two to three times if they dewater to the maximum feasible solids content of ten percent. New York City would then gain a savings in transportation cost of more than $11.0 million per year. It was estimated that dewatering of sludge to ten percent solids for all sewerage authorities would reduce 106-mile site costs from $37.3 million to $19.3 million. This would reduce economic impact indicators also by the same magnitude.

As discussed on page V-1, baseline sewage costs do not include all sewer collection system maintenance charges. Actual costs based on ad valorem or frontage length taxes may also include a component for system maintenance costs incurred by the municipality. This cost might significantly increase baseline residential costs but would have to be three to five times the total 106-mile treatment cost to show adverse economic impacts. An estimate of this limit can be made through use of data supplied by New York City and Nassau County. Municipal collection costs for these two sewerage authorities were $36,639,000 and $20,074,000, respectively. These costs represent 65 percent and 100 percent of the respective authorities baseline sewage treatment costs shown in Table V-1. Only New York City costs would then increase close to the one percent threshold level at 0.9 percent but would remain below the $200 per household threshold at $120.23 per household. In aggregate New York City, impacts per household would be greater than for other communities if actual costs per household were greater than the estimates used. But none of the threshold indicators would be surpassed for any of the communities.

INDEX CODE: 2.5

Other

~~DOCUMENT~~ CONTROL ~~SHEET~~

DOCUMENT NO.	AUTHOR	DOCUMENT	DATE
	EPA - Office of Water Regulations and Standards	Economic Analysis of Shifting Ocean Disposal of Sewage Sludge from the 12 mile Site to the 106-Mile Site	May 1984
	U.S. EPA	Final Environmental Impact Statement for 106-Mile Ocean Waste Disposal Site Designation and Appendices	Feb 27, 1980
	Executive Resource Associates	List of Ocean Dumping Sites in 40 CFR 228.12 (contract #68-03-4045)	april 24, 87
	National Business Consultants/ Executive Resource Associates	Corrected Ocean Disposal Site Designations	Jan 30, 87

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Other

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